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ABSTRACT

In this paper the morphological argument for the conditioning of Sanskrit aspiration and deaspiration is renewed in theoretically current terms, bringing forth new arguments and examining previously undiscussed major weaknesses in the purely phonological (autosegmental) argument. Relevant phonological, morphological, and lexical facts are outlined. A theory accounting for the non-phonological aspiration throwback alternations is presented, and it is argued that two recent purely phonological accounts of aspiration throwback have failed to make a convincing case. Additional general and specific arguments for the relevance of process morphology in Sanskrit aspiration throwback are presented. (MSE)

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IN FURTHER DEFENSE OF A NON-PHONOLOGICAL ACCOUNT FOR SANSKRIT ROOT-INITIAL ASPIRATION ALTERNATIONS*

Richard D. Janda (University of Pennsylvania) & Brian D. Joseph (The Ohio State University)

0. INTRODUCTION

The analysis of Sanskrit morphophonology has long been a battleground on which the warring opponents have been precisely the forces of morphology vs. the forces of phonology. This is the case, for example, with certain alternations between aspirated and unaspirated segments, as in the **bhud-** vs. **budh-** allomorphs of the Sanskrit root for 'know'. Within the generative period, the battle over the conditioning of the rules which account for such alternations began toward the end of the field's first decade (cf. Kiparsky 1965 and Zwicky 1965). At this time, the initiative was seized by linguists who were participating in a campaign to treat maximally many phenomena involving sound as matters of phonology and therefore analyzed all Sanskrit aspiration and deaspiration via purely phonological rules. Despite continuing disagreement within the phonologists' ranks as to tactics (i.e., the most effective specifications of underlying forms, rules, and ordering—cf., e.g., Anderson 1970 vs. Vennemann 1979), the purely phonological position was later maintained and reinforced over a period of ten years by a succession of analysts culminating with Hoard 1975 and Phelps 1975.

The approach in question, however, was soon countered by Sag 1974, 1976 and Schindler 1976, who advanced evidence that the relevant aspiration alternations were governed by at least some morphological conditions and so to be accounted for in part by morphological rules. In promoting this view, the latter two scholars were retaking the position staked out more than two millenia earlier by the native Sanskrit grammarian Pāṇini, who assigned to "most of the phenomena in question ... a morphological rather than a phonological explanation" (Sag 1976:621). Almost immediately, though--in the late 1970's and early 1980's--the rules of engagement for the field of sound-structure changed drastically: away from segment-based, "linear" approaches and toward more suprasegmental, "nonlinear" ones. It was thus only to be expected that the next generation of phonologists would employ their new autosegmental armamentarium in launching an attempt to recapture the generalizations in the domain of Sanskrit aspiration and deaspiration by means of yet another kind of purely phonological analysis. And that is precisely what happened. First Stemberger 1980, then Borowsky and Mester 1983, and finally Kaye and Lowenstamm 1985 provided autosegmental-phonological accounts of varying sorts for the aspiration alternations in Sanskrit.

At this point, accordingly, we feel compelled to join the fray, on the side of the again-beleaguered morphologists. And so, in the spirit of demonstrating that not all rules which affect sounds are necessarily phonological in nature, we here undertake to defend a non-phonological approach for an irreducible core of the Sanskrit aspiration alternations. Given that it has been strongly championed in the past (e.g., by Sag and Schindler, not to mention Pāṇini), the general treatment which we argue for below is admittedly not novel. Nevertheless, we believe that this paper represents a genuine advance in the analysis of Sanskrit aspiration and deaspiration, since it not only both entrenches the specifics of our morphological account in up-to-date, theoretically current terms and marshals new arguments in their favor but also points out certain previously undiscussed major weaknesses in the purely phonological autosegmental position of its competitors. Thus, while the present study of conflicting approaches to Sanskrit aspiration obviously lacks some of the dramatic sweep and wide-ranging religio-philosophical relevance of an Indic war-epic like the Bhagavad-Gītā, it does have an important moral point to make for linguistics concerning the ability of a properly updated morphological analysis to hold its own, in the field of sound-structure, against even the most innovative arsenal of representational devices deployed by recent purely phonological accounts.

1. THE RELEVANT PHONOLOGICAL FACTS

In order to set the stage for a discussion of phonological vs. morphological conditioning of the various aspiration phenomena in Sanskrit, we must first briefly outline the relevant data. The range of alternations involving aspiration in the language is rather large, since there are instances not only of

underlyingly aspirated consonants becoming deaspirated but also of underlyingly unaspirated consonants becoming aspirated. Some of these alternations are locally determined, by an adjacent element (segment or morpheme), while others are distantly conditioned, by a non-adjacent element.

Among the locally conditioned alternations, we find root-final underlying aspirates deaspirated immediately before a suffix with an initial obstruent--either /s/ or a stop; this is achieved by a fully general, purely phonological rule, since [+aspirated][-sonorant] sequences do not occur in Sanskrit.[1] In (1) below are given some examples of this process before -/s/...--hence, for instance, in verbal aorist system formations with a sibilant-initial suffix, in one desiderative formation, in one future formation, and in certain second-person singulars, as well as in the locative plural of root nouns. The cases in (2) show deaspiration before the underlying voiceless dental stop -/t/...--hence, for example, in a number of verbal participles and other non-finite forms, in certain second- or third-person singulars, and in some derived nouns. Finally, (3) exemplifies deaspiration before a stop other than /t/: e.g., before -/dh/...--hence, for instance, in certain imperatives. In (1), it is important to note also that root-final deaspiration is accompanied (in the same segment) by the effects of an independently motivated, purely phonological rule of anticipatory-assimilatory devoicing in voiceless-final obstruent clusters (cf., e.g., nominal yug-a- 'yoke' vs. verbal yuk-ta 'yoked, joined'). In (2), similarly, root-final deaspiration of a voiced obstruent is complemented by a phonological process of perseverative voicing- and aspiration-"transfer"--commonly referred to as "Bartholomae's Law" (BL)--which affects an immediately following suffix-initial stop, effectively always a dental.[2]

(1) √**rabh**- 'seize' --> DESID. **rip-sa-**, FUT. **rap-sya-**
√**yudh** 'fight' --> 2.SG.PRES.IND.ACT. **yot-si**, FUT. **yot-sya-**, AOR. **yot-si:-**
√**vṛdh**- 'increase' --> LOC.PL. (root noun) **vṛt-su**
(2) √**gṛdh**- 'be greedy' --> PST.PRTCPL. **gṛd-dha-** (< /gṛdh-ta-/)
√**duh**- 'milk' --> 3.SG.PRES.IND.ACT. **dog-dhi** (< /doh-ti/)
√**budh**- 'know' --> F[EM].NOUN (derived) **bud-dhi-** (< /budh-ti-/)
(3) √**duh**- 'milk' --> 2.SG.IMPER.ACT. **dug-dhi** (< /duh-dhi/)

Underlyingly aspirated root-final stops deaspirate when word-final--e.g., in nominal forms such as:[3]

(4) √**kapṛth**- 'penis' --> N[EU]T[E]R.NOM./ACC./VOC.SG. **kapṛt**
√**samidh**- 'wood' --> F.VOC.SG. **samit**

There also occur locally determined alternations between underlyingly unaspirated suffix-initial **t**... (or aspirated **th**...) and derived-aspirated (and -voiced) suffix-initial **dh**...; the latter alternant occurs after a root-final underlyingly voiced aspirate--hence, to repeat, in a number of verbal participles and other non-finite forms, in certain second- or third-person singulars, and in some derived nouns. It is this alternation, exemplified in (5) below, which--together with that illustrated in (2) above--forms the core of the combined phenomenon commonly referred to (cf. above) as BL:

(5) /**gṛdh-ta-**/ 'be greedy'-PST.PRTCPL. --> **gṛd-dha-**
/**doh-ti**/ 'milk'-3.SG.PRES.IND.ACT. --> **dog-dhi**
/**budh-ti-**/ 'know'-F.NOUN (derived) --> **bud-dhi-**

Two significant instances of distantly conditioned aspiration alternations are found in Sanskrit. First, in reduplication, underlyingly aspirated root-initial stops are copied as deaspirated segments (hence, e.g., in certain verbal perfect-, desiderative-, intensive-, aorist-, and present-stems):[4]

(6) √**dham**- 'blow' --> PERF. **da-dhm-**, INTENS. **da:-dhma:-ya-**, DESID. **di-dhma:-sa-**
√**phal**- 'burst' --> PERF. **pa-phal-**, DESID. **pi-phal-iṣa-**, AOR. (a)**pi:-phal-a-**
√**bhṛ**- 'bear' --> PRES. **bi-bhar-**, DESID. **bu-bhu:r-ṣa-**

Second, in what is often termed the "aspiration throwback" effect (ATB),[4] underlyingly unaspirated root-initial segments alternate with aspirated root-initials in conjunction with the root-final deaspiration found, for example, not only before -/s/... (as in (1) above), before -/t/ (as in (2) above), and before certain voiced-aspirate-initial consonant clusters (parallel to (3) above), but also in actual word-final position (parallel to (4) above) and in certain inflected forms for which an internal word boundary[5] is traditionally posited between a root-final segment and a following stop-initial inflectional marker, such as the instrumental-plural ending -/bhis/. Thus, ATB occurs in certain verbal futures, desideratives, and aorists, and second- or third-person categories, as well as in various nominal case-forms, including also the ablative plural and the instrumental/dative/ablative dual:

(7) a. √**druh**- 'be hostile' --> FUT. (stem) **dhrok**-ṣya- (< /droh-sya-/)
b. √**bandh**- 'bind' --> DESID. (stem) bi-**bhant**-sa- (< /bi-bandh-sa-/)
c. √**dih**- 'smear' --> AOR. (stem) a-**dhik**-ṣ- (< /a-dih-s-/)
d. √**duh**- 'milk' --> 2.SG.PRES.IND.ACT. **dhok**-ṣi (< /doh-si/)
e. √**dagh**- 'reach' --> 2.SG.AOR.IND.ACT. a-**dhak** (< /-dagh-s/ or < /-dagh•/[3])
f. √**budh**- 'know' --> NOM./VOC.SG. (root noun) -**bhut** (< /-budh-s/ or < /-budh•/[3])
g. √**budh**- 'know' --> LOC.PL. (root noun) -**bhut**-su (< /-budh•su/)
h. √**dah**- 'burn' --> 3.SG.AOR.IND.ACT. a-**dha:k** (< /-da:h-t/ or < /-da:h•/[3])
i. √**duh**- 'milk' --> INSTR.PL. (root noun) -**dhug**-bhis (< /-duh•bhis/[5])
j. √**duh**- 'milk' --> 2.PL.PRES.IND.MID. **dhug**-dhve (< /duh-dhve/)
k. √**duh**- 'milk' --> 2.PL.IMPF.IND.MID. a-**dhug**-dhvam (< /a-duh-dhvam/)

It is noteworthy that ATB does not cooccur with the deaspiration which takes place before the morpheme-initial stop of either the 2.SG.IMPER.ACT. ending (cf. (3) above) or any ending that triggers (and is affected by) BL (cf. (2) and (5) above).

The above alternations can be boiled down to the distributional pattern given in (8) below. There, the contexts for the various abovementioned alternants are stated in terms of boundaries and phonological segments, besides being supplemented with additional alternants and environments reflecting an independently motivated phonological rule of anticipatory voicing assimilation which--in the fully general form assumed here--applies (only) across word boundaries, altering a stop based solely on the voicing of the immediately following segment in a phonological phrase. The contrast between tautolexical atra 'here' and heterolexical /a-vada-t • ra:mas/ --> avadad ra:maḥ 'spoke Rāma' = 'Rāma spoke' shows the exclusively external nature of this sandhi rule. The confluence of all the above generalizations thus yields an overall situation where the four allomorphs of a root like √budh- have the following basic surface distribution (whereby it should be noted that (8)b.ii and (8)c.ii below are nearly identical, differing only as a result of the phonological rule just mentioned):[6]

(8) a. **budh**- /__ [+sonorant] (i.e., before a resonant--/(l,) m, n, r, v, y/--or a vowel)
b. **bhut**-
i. /__ [+strident, -voice] (i.e., before the voiceless fricative /s/)
ii. /__ • [-voice] (i.e., before a morpheme-initial voiceless segment which either begins another word or acts as if it were preceded by a word boundary)
iii. /__ • ¶ (i.e., in absolute-final position [= before a pause (¶)])
c. **bhud**-
i. /__ [+voice, +aspirated, +coronal] [-syllabic, -consonantal, +labial] (i.e., before the consonant cluster /dhv/)
ii. /__ • [+voice] (i.e., before a morpheme-initial voiced segment which either begins another word or acts as if it were preceded by a word boundary)
d. **bud**- / __ [+voice, +aspirated, +coronal] V (i.e., before a voiced dental aspirate ([dh]) followed by a vowel (where [dh] can be either underlying or derived from /t/)

In the remainder of this paper, we concentrate almost entirely on aspiration-throwback allomorphy, for it represents the central set of alternations that are the focus of the recent phonological accounts of Sanskrit aspiration phenomena we argue against here. That is, while we readily grant the purely phonological nature of the root-final aspiration alternations exemplified above in (8), we believe that the phonologically based contexts given there for aspirate-initial allomorphs--i.e., the ATB ones in (8)b and c--are actually quite misleading. This is because the phonological purity and simplicity of the relevant environments imply that aspiration throwback is a consistent, systematic process such that: (i) ATB affects virtually all roots appropriately containing final aspirates--and so has few or no lexical exceptions; (ii) ATB is triggered not by morphemes but by segments occurring in a wide, morphologically disparate range of grammatical contexts (i.e., suffixes)--so that there is no phonologically appropriate morphological category where ATB always fails to apply, nor any appreciable morphosyntactic consistency across the environments where it does apply, and (iii), most basically, ATB applies only in the environments listed in (8)b-c above, never in any others (whether phonological, morphological, or lexical). When, however, the lexical and morphological contexts for ATB are examined closely, a strikingly different picture emerges. In fact, none of the three predictions just listed is borne out, since: (i) at least one of ATB's alleged phonological triggers actually occurs only in a single morphological category, while the process shows considerable lexical idiosyncrasy and inconsistency in its (non-)application; (ii) ATB fails to apply in at least one entire morphological category, even though the relevant suffix is phonologically appropriate, while the grammatical contexts where it applies cluster around a small set of morphosyntactic categories, and (iii) ATB sporadically applies in environments which are phonologically and morpholexically distinct from those given above.

2. THE RELEVANT MORPHOLOGICAL AND LEXICAL FACTS

In considering the rather extensive counterevidence which faces any and all versions of a purely phonological account for Sanskrit ATB, we begin by presenting as (9) below the full range of morphological categories in which aspiration throwback is found:

(9) a. certain case-forms of root nouns:
  i. M[ASC]./F.NOM.SG. (-/s/ > Ø[3]--though possibly just -Ø), as in (7)f above; plus NTR.NOM./ACC.SG. (-Ø) and M./F./NTR.VOC.SG. (-Ø)
  ii. the "-/bh/..."-cases: e.g., the INSTR.PL. (-/bhis/), as in (7)i above, plus the DAT./ABL.PL. (-/bhyas/) and the INSTR./DAT./ABL.DU. (-/bhya:m/)--all of which trigger external types of sandhi[5]
  iii. LOC.PL. (-/su/), as in (7)g above--also an external-sandhi trigger ("pada form")[5]
 b. verbs marked for one type of future stem: that with the suffix -/sya/-, as in (7)a above (but not in futures with the suffix -/iṣya/-)
 c. verbs marked for one type of desiderative stem: that with the suffix -/sa/-, as in (7)b above (but not in futures with the suffix -/iṣa/-)
 d. verbs marked for either of two types of aorist stems:
  i. that formed by any of the -/s/-initial suffixes -/s/- (as in (7)c above) or -/sa/- or -/siṣ/- (but not by the suffix -/iṣ/-)
  ii. that formed without any aorist-suffix at all--but only in the second- and third-person singular of such root aorists: cf., respectively, (7)e and h above, where these person/number combinations are marked by the respective underlying suffixes -/s/ and -/t/ (see below; both endings, however, are ultimately deleted[3])
 e. various second-person singular and plural forms, plus one third-person singular form:
  i. "primary" 2.SG.ACT. -/si/ (as for the PRES.IND. in (7)d above), plus "secondary" 2.SG.ACT. -/s/ (e.g., for the root aorist mentioned in [(9)]d.ii and (7)e above),[3] "primary" 2.SG.MID. -/se/, and imperative 2.SG.MID. -/sva/
  ii. middle 2.PL. -/dhve/ (as in (7)j above) and -/dhvam/ (as in (7)k above)
  iii. "secondary" 3.SG.ACT. -/t/ (as for the root aorist in [(9)]d.ii and (7)h above)[3]

As a result, ATB appears hardly at all in Sanskrit nouns, since it occurs only in the tiny voiced-aspirate-final subset of the small set of root nouns--and then only in 5 out of 13 phonologically distinct case forms, 4 of the 5 being relatively uncommon oblique duals and plurals. Thus, e.g., for √**duh**- 'milk' as a root noun, there is no ATB in ABL./GEN.SG -**duh**-as or in any of the other 7 distinct case forms with vowel-initial endings. In verbs, ATB is not quite so rare, but it is once again obviously limited to the small set of voiced-aspirate-final roots, and there occurs mainly with a handful of stem formants. Otherwise, the occurrence of ATB within verb paradigms--as a concomitant of certain person/number suffixes--is quite sporadic, as shown by the following forms for √duh 'milk':

(10) a. PRES.IND.ACT.:

1.SG.	doh-mi	1.DU.	duh-vas	1.PL.	duh-mas
2.SG.	**dhok**-ṣi	2.DU.	dug-dhas	2.PL.	dug-dha
3.SG.	dog-dhi	3.DU.	dug-dhas	3.PL.	duh-anti

b. PRES.IND.MID.:

1.SG.	duh-e	1.DU.	duh-vahe	1.PL.	duh-mahe
2.SG.	**dhuk**-ṣe	2.DU.	duh-a:the	2.PL.	**dhug**-dhve
3.SG.	dug-dhe	3.DU.	duh-a:te	3.PL.	duh-ate

As can easily be seen from the list already given further above in (9), the Sanskrit forms which show ATB are far from being a totally disparate set. For verbs, they cluster around certain morpho-syntactic categories mainly involving tense/aspect (future, aorist, and desiderative) and person/number (especially second person, although once also third, and frequently plural number, although also singular). For nouns, ATB has its principal morphological concentration in the oblique cases (instrumentals, datives, ablatives, and locative, although also an isolated nominative, accusative, and/or vocative) and in the non-singular numbers (dual and plural, although occasionally also the singular).

Moreover, in that their distribution sometimes deviates from the basic environmental patterns given as (8) above, Sanskrit ATB forms show a fair amount of phonologically exceptional behavior which can hardly be described--let alone explained--other than in morpholexical terms. First of all, there are several instances of words where ATB fails to manifest itself at all; cf. (11) below:

(11) a. the Vedic nonce-form (mitra-)**druk** 'seeking to injure(a friend)'--NOM.SG of a root noun from √**druh**- 'be hostile'--has no ATB accompanying deaspiration of its root-final stop (though expected (mitra-)**dhruk**, with ATB, also occurs)

b. besides examples with expected ATB, Vedic also has variant verb forms which lack ATB in formations with -/s/...--but only for certain morpholexical categories; e.g., for √**duh**- 'milk', there is an aorist stem **duk**-ṣa- (alongside **dhuk**-ṣa-); for √**guh**- 'hide', there is the desiderative stem ju-**guk**-ṣa- (alongside aorist **ghuk**-ṣa-), etc.[7]

c. a few synchronically restructured and lexicalized non-verbal forms lack ATB even though their roots occur before -/s/...; e.g., **gṛt**-sa- 'clever' ultimately (at least etymologically) derives from √**gṛdh**- 'be greedy'.[8]

Even more important, ATB is found in part under contradictory conditions which make it essentially impossible to characterize with any phonological naturalness. In particular, although the nominal case suffixes -/bhis/, -/bhya:m/, -/bhyas/, and -/su/ are elsewhere preceded by external types of sandhi (cf. Sag 1974:602-4), one can legitimately question the artifice of analyzing an ATB form like the INSTR.PL. root-noun -**bhud**-bhis as having an internal # (i.e., as deriving from -/budh#bhis/; recall (7)g above). The fact that LOC.PL. -/su/ also exhibits internal sandhi (cf., e.g., Brodie 1984) bolsters the alternative approach of simply providing it and the -/bh/...-suffixes with morpholexical marking for their unusual, post-#-like behavior. But it is then difficult to explain why ATB cooccurs with deaspiration before -/bh/-initial endings but not before -[dh]-initial ones like underlying -/dhi/ 2.SG.IMPER.ACT. and the derived -[dha]-, -[dhi], etc. created by BL (recall (2) and (5) above): that

is, why should the aspiration of a root-initial stop depend on the place of articulation of a following suffix-initial aspirate, with the process being triggered by a bilabial but blocked by a dental?

It has been already mentioned here, however, that ATB sometimes actually does cooccur with deaspiration before a suffix-initial /dh/, but only when the next segment is /v/--i.e., with the two 2.PL.MID. endings -/dhve/ and -/dhvam/--and thus not before 2.SG.IMPER.ACT. -/dhi/. Thus, a purely phonological account must contain as a crucial conditioning element for ATB the labial segment /v/ (cf. (8)c.i above). Alternatively, one could try to combine the -/dhv/...- and -/bh/...-environments via reference to their both containing a labial. However, these approaches are noticeably lacking in phonetic plausibility. And, at any rate, it is actually necessary to retract the statement that ATB regularly occurs before -/dhv/...--and consequently also to alter the -/dhv/...-environment in (8)c.i above--because ATB never occurs before the -[dhva:]-variant which arises from the gerund -/tva:/ when it follows a voiced aspirate and therefore undergoes the perseverative aspiration- and voicing-transfer of BL (cf., e.g., from √**dah-** 'kindle', **dag-dhva:** < /dah+tva:/). Nor is it even possible to avoid this difficulty straightforwardly by ordering ATB before BL and so changing -/tva:/ to -[dhva:] only after ATB has failed to apply preceding -/t/.... This is because, for "weak" present-system forms of the root √dha:- 'put'--those based on **dadh-** (cf. (12)b below)--BL fails to operate and ATB in fact applies not only before -/tva:/ (cf. the likewise vocalically altered **dhit-tva:**) but also before all the remaining -/t/...- and -/th/...-endings of Sanskrit which otherwise trigger BL.

While the idiosyncratic cases in (11)a-c have the important function of showing that Sanskrit ATB has significant morpholexical exceptions, the much more systematic phenomena discussed in the immediately preceding paragraphs demonstrate that any attempted purely phonological account cannot escape the necessity of specifying at least some ATB environments in terms of entire morphological categories. Most important, morphological reference is here necessary in order to avoid either globality or a phonological ordering paradox (one different from that likewise obviated morphologically by Sag 1974, 1976): if ATB is ordered following BL, then only morphological restrictions can prevent the former from applying before derived [dhv] (as opposed to underlying /dhv/), but ATB cannot be ordered preceding BL without morpholexical restrictions (mentioning certain forms of √dha:-) which allow ATB to apply only before -/t/...-suffixes that will in fact not later undergo BL (and so not become [dh]). We therefore seem to have little choice but to drop phonological pretense and to analyze the ATB that does or does not cooccur with deaspiration before underlyingly dental-stop-initial suffixes as simply being conditioned non-phonologically, by particular morphemes. As things turn out, it does not really matter what degree of phonological generality or specificity is tried as an additional purely phonological following environment for ATB (aside from that before /s/ or pause); it is actually irrelevant whether the attempted context involves, singly or together, /dhv/ and/or /dh/ and/or /bh/ and/or /t/ and /th/ and/or voiced aspirated stops or voiced stops or even stops generally: each such attempt requires specification for one or more additional, non-phonological, morphological contexts--some of which must be negative (e.g., the blocking of ATB before 2.SG.IMPER.ACT. -/dhi/) and so pattern with the other exceptional non-applications of ATB listed in (11) above.

On the other hand, some morphological contexts for ATB must be positive, in that they represent phonologically exceptional (extra) applications. For one thing, there is the abovementioned requirement of specifying ATB as triggered by 2.PL.MID. -/dhve/ and -/dhvam/. Yet this is not the only such case--not even if we posit internal word boundaries inside ATB forms having /bh/-initial suffixes (rather than perhaps more honestly admitting that such forms' acting as if they contained # is a morpholexical property, just like their undergoing ATB)[5]. Rather, it is also necessary to admit that some Sanskrit roots with final voiced aspirates show ATB in contexts other than those mentioned above in (8) (and (9), too); cf. (12) below:

(12) a. the "weak" present-system forms of the root √dha:- 'put'--seen in, e.g., 1.PL.PRES.IND.ACT. **dadh-mas**--reflect originally reduplicated /da-dh-/, where the first stop (the one in the reduplication syllable) was once regularly deaspirated (cf. (6) above). But some weak forms, such as 3.SG.PRES.IND.MID. **dhat-te** (cf. also the gerund

dhit-tva: in (11)e above) and 2.PL.IMPF.IND.MID. **a-dhad**-dhvam, unexpectedly show ATB for their first stop when the root-adjacent suffix is respectively either a /t/-initial ending (albeit one associated with no BL-effect) or -/dhvam/ (or -/dhve/). This suggests that the weak stem /dadh-/ was at some point reanalyzed as a root allomorph which exceptionally both fails to undergo BL and succeeds in undergoing ATB.

b. the Vedic nonce-form **dhak**-tam (2.DU.AOR.INJ.ACT. of √dagh- 'reach') shows not only expected root-final deaspiration (and root-final devoicing before a voiceless obstruent) but also unexpected root-initial ATB before a following -/t/:. (and so is another form which unexpectedly fails to follow BL).

In addition, it is significant that Sanskrit also has several roots whose initial and final stops show extremely unsystematic alternations between unaspirated and aspirated qualities that are totally independent of any suffixal context and are sometimes even unaccompanied by aspiration elsewhere in their root which could somehow trigger such an effect. Some such cases are listed below in (13):

(13) a. Vedic dhṛsad- (attested only once) / dṛsad- 'rock, millstone'
b. √bharbh- / √bharb- 'injure'; √dṛph- / √dṛp- 'torture'
c. √dhra:gh- / √dra:gh- 'be able'; √dhra:kh- / √dra:kh- 'become dry'
d. √dhrek- / √drek- 'sound'; √dhra:ḍ- / √dra:ḍ- 'split'

Admittedly, it is not always obvious from such examples which is the innovative form and which the original; most are attested only very late in the Sanskrit corpus or only in native lexicographical works. While, on the one hand, there thus exists no systematic explanation for these alternations, they clearly suggest, on the other hand, precisely that there can be no general principle which accounts for all Sanskrit aspiration alternations without referring to particular lexical items. In other words, at least some such alternations must have been morpholexical in nature, since they were keyed to specific roots. This observation figures significantly in the discussion in Section 3, where we provide further motivation for a non-phonological approach to the Sanskrit ATB alternations.

3. ACCOUNTING FOR THE SANSKRIT ATB ALTERNATIONS NON-PHONOLOGICALLY

As noted at the outset of this paper, the problem of how to account for the various Sanskrit aspiration alternations--especially ATB--has been attacked by linguists for centuries. Early generative phonologists offered accounts which were not only purely phonological but also, incidentally, quasi-etymological, since their essence was that initial stops in underlyingly diaspirate roots were dissimilatorily deaspirated whenever aspiration survived root-finally, this giving the ATB effect without any "throwback". Such solutions ultimately yielded to the morphologized analyses of middle-generation generativists--whose accounts employed ATB, in the Pāṇinian manner, based on considerations similar but not identical to those discussed here in the previous section. The central process in such treatments was an assimilatory root-initial aspiration like (14) below (= (26) in Sag 1976:616):[9]

(14) $\begin{bmatrix} +\text{obst} \\ +\text{voice} \\ -\text{palatal} \end{bmatrix} \rightarrow [+\text{asp}] \,/\, [_{\text{ROOT}} __ [+\text{seg}]_0 [+\text{asp}]_{\text{ROOT}}] \begin{Bmatrix} \textbf{s} \\ \textbf{dhve} \\ \textbf{dhvam} \\ \textbf{-} \end{Bmatrix}$

Even a-priori, a non-phonological approach to ATB is perhaps to be expected as necessary, since there are other aspiration alternations in Sanskrit which are best treated as morphological in character. E.g., there is a need for prespecification--as [-aspirated]--of the templates in most instances of verbal reduplication, as shown below by the contrast of (15a) (cf. also (6) above), exemplifying the general case of [-aspirated] reduplication which is typical for nearly all verbal categories, vs. the restricted verbal type in (15b) and the denominal-adverbial reduplication shown in (15c) (for fuller discussion, cf. Janda & Joseph 1986):

(15) a. √**dham-** 'blow' --> PERF. **da-dhm-**, INTENS. **da:-dhma:-ya-**, DESID. **di-dhma:-sa-**
√**phal-** 'burst' --> PERF. **pa-phal-**, DESID. **pi-phal-iṣa-**, AOR. (a)**pi:-phal-a-**
√**bhṛ-** 'bear' --> PRES. **bi-bhar-**, DESID. **bu-bhu:r-ṣa-**
b. √**bhṛ-** 'bear' --> INTENS. **bhari:-bhṛ-** (Vedic only)
√**han-** 'smite' --> INTENS. **ghani:-ghan-** (Vedic only)
c. **ratha-** 'chariot' --> **ratha:rathi** 'chariot against chariot'

Further, it should be noted that the number of roots with attested ATB-forms is actually extremely minuscule, totaling only 13 in all (cf., e.g., Whitney 1885, 1889, Hoenigswald 1965):

(16) √dagh- 'reach'; √dah- 'kindle', √dih- 'smear', √duh- 'milk', √druh- 'be hostile',
√ga:h- 'plunge', √guh- 'hide', √grah- 'seize', √dṛṃh- 'make firm';
√ba:dh- 'oppress', √budh- 'know'; √bandh- 'bind'; √dabh- 'injure'

There are, moreover, many other roots (e.g., √dimbh- 'order', √gu:rdh- 'exult') which could show (or fail to show) ATB allomorphs if they happened to have appropriate formations--e.g. a future with -/sya/-, not -/iṣya/-; a desiderative with -/sa/-, not -/iṣa/-, etc.--but which simply present no relevant evidence. While the exact status of these roots with regard to ATB is unknown, their existence does not change the overall rarity of attested ATB roots (cf. also footnote 8).

Overall, then, the numerous key indicators for the non-phonologicality of ATB--and hence its morphological and/or lexical nature--can be combined from this and the preceding section and summed up here as follows: some instances of the presence or absence of ATB can be characterized, whether positively or negatively, only in morphological terms (e.g., never preceding the suffix -/dhi/; cf. (3) above); forms with ATB have a relatively sporadic distribution within their paradigms (e.g., for one type of present-tense formation, only in the 2.SG./PL. and so not even in the 2.DU.; cf. (10) above), but the categories where ATB appears are concentrated around a small number of morphosyntactic property clusters (cf. (9) above--e.g., the set of root-noun oblique cases in (9)a.ii-iii); early Vedic, at least, shows a partly morphologically-linked cross-dialectal variation with regard to the presence or absence of ATB (cf. (11)a-b; e.g., desiderative ju-**guk-ṣa-** vs. aorist **ghuk-ṣa-** for √**guh-** 'hide' in (11)b); there are lexically specified exceptions to ATB, especially in the present system of √dha:- 'put' (cf. (12)a above); there are numerous irregularities and unsystematic alternations with regard to the realization of ATB (cf. (11)c, (12)b, and (13) above), and, finally, the number of roots actually manifesting ATB forms is extremely small (cf. (16) above).

4. CONTRA TWO RECENT PURELY PHONOLOGICAL (AUTOSEGMENTAL) ACCOUNTS OF ATB

One might think that, with the morphologized ATB-accounts in Sag 1974, 1976 and Schindler 1976 reaffirming Pāṇini's insights of 2,500 years earlier, the book on Sanskrit ATB could be considered closed. Nevertheless, we have here further emphasized the morpholexical nature of the ATB effect for the reason that the development of Autosegmental Phonology over the last decade or so has allowed and encouraged a return to purely phonological analyses of Sanskrit. This is especially so because ATB involves relations between the presence vs. absence of a single phonological feature (= aspiration) in segments of the same general type (= voiced stops) at two different positions (= initial and final) within a domain (= a root) whereby the value of the second position for the relevant feature is often affected phonologically by adjacent elements (= pauses and suffix-initial segments). Prima facie, this all sounds like a case tailor-made for an autosegmental treatment which is not only purely phonological but can even be expressed largely in terms of universal operations and conventions for "delinking" (of a conditioned, assimilatory sort), "floating", and "relinking". In fact, two accounts of exactly this sort have relatively recently been proposed for the Sanskrit ATB alternations: one by Borowsky & Mester 1983 (B&M) and one by Kaye & Lowenstamm 1985 (K&L).[10]

The central claims and components of B&M's and K & L's autosegmental accounts are as follows:

(17) a. voiced aspiration (as in /bh/, etc.) and voiceless aspiration (as in /ph/, etc.) do not constitute a single phenomenon but must instead be kept separate and treated as only indirectly related to each other .
b. voiced aspiration is autosegmentally represented, and thus universal "linking"/"association" conventions, rather than language-specific ones, can appropriately govern its "floating" and "relinking" ("reassociation") with the nearest (and only other) stop in a root--an initial one--after voiced aspiration is "delinked" from a root-final voiced aspirate via the latter's interaction with a suffix-initial obstruent or a pause
c. voiceless aspiration is represented not autosegmentally but instead segmentally
d. because (so B&M) only voiced segments are "legitimate bearers" of autosegmental voiced aspiration, delinking (like the subsequent floating and relinking noted in (b) above) can be achieved automatically when a root-final voiced aspirate is devoiced
e. alternatively (so K&L), delinking of voiced aspiration is obligatory in syllable codas

Despite the initial attractiveness of such phonological ATB accounts, we feel that the approaches of neither B&M nor K&L can be maintained. In particular, one of the essential points of the autosegmental analyses--the differential treatment of voiceless and voiced aspiration (cf. (16)a-c above)--can be shown to be unsupported by the evidence of Sanskrit phonology. This refutatory evidence is presented below in (18), which shows that the two types of aspiration are phonologically unified in at least three major ways (for more discussion, see Janda & Joseph 1987, Joseph & Janda 1988b):

(18) a. both kinds of aspirated stops deaspirate word-finally; cf. (4) above
b. both kinds of aspirated stops deaspirate in reduplication; cf. (5) above
c. in the Pre-Indic period (cf. Schindler 1976:626), voiced aspirates had the effect (via Grassmann's Law, as a sound-change) both of triggering deaspiration in voiceless aspirates and of undergoing deaspiration triggered by the latter, as shown by the forms **vidatha-** 'distribution' < *vi-**dh**-**atha**- (where the combination vi- + √dha:- = 'distribute') and **kumbha-** 'pot' < *k**humbha**- (cf. Avestan xumba-)

Similarly, as exemplified above in (7)i-k, respectively, nominal forms like root noun INSTR.PL. **-dhug**-bhis (< /-duh*bhis/) and verbal ones like 2.PL.PRES.INDIC.MID. **dhug**-dhve and 2.PL.IMPF.IND. MID. **a-dhug**-dhvam show an ATB allomorph **dhug-**. Such examples demonstrate that deaspiration and ATB need not always be accompanied by devoicing, as required on B&M's analysis. While it is true that the nominal form above can be argued to contain an internal word boundary preceding its case ending, it is also true that the root allomorph **-dhug** is exactly what is expected in the environment "/ ___ * [+voice]" (parallel to **-bhud** in (8)c above). The only apparent solution to this problem involves an unmotivated rule of devoicing at all morpheme boundaries--a process which then entrains ATB when the autosegmental aspiration feature of an underlyingly voiced root-final aspirate delinks, floats, and relinks with a root-initial voiced stop. However, root-final stops preceding a voiced obstruent must then be "revoiced" via a corresponding process of voicing assimilation (admittedly an available, independently motivated rule) . Such a solution, however, is quite ad hoc and thus seems generally unsatisfactory. This is especially so in light of the fact that Pāṇini's grammar has an obligatory rule of word-final voicing (and deaspiration; = 8.2.39; cf. Katre 1987:998) but only an optional rule of prepausal devoicing (and deaspiration; = 8.4.56, p. 1064--plus, as above, an obligatory rule of devoicing before a following voiceless segment; = 8.4.55, p. 1063). Pāṇini thus clearly adopts the view that the devoicing of a root-final obstruent is mainly dependent on what (if anything) actually follows it, rather than on any boundary--of a morpheme or even of a word--which may be present.

At least for ATB allomorphs before -/dhv/...-initial suffixes, B&M 1983 actually seem to share our antipathy towards a devoicing-cum-revoicing analysis: they concede (p. 55) that the "fact that the suffixes -dhve and -dhvam condition throwback is an idiosyncratic fact about these morphemes and on any account will have to be stated as such". However, they do not draw from this necessary concession--that Sanskrit ATB is at least partly morphologically conditioned--the obvious conclusion

that they cannot offer a unified account for that overall phenomenon. Moreover, their description of "throwback" before -/dhve/ and -/dhvam/ implies that root-final deaspiration occurs before such suffixes in forms like 2.PL.PRES.INDIC.MID. **dhug**-dhve, but this--along with their explicit positing of root-final deaspiration in ATB noun forms like INSTR.PL. -**bhud**-bhis--would require B&M to abandon their crucial claim that orthographic ...**DDh**... sequences are phonetically [...DhDh...] and that therefore no deaspiration accompanies BL in forms like PST.PRTCPL. **bud-dha** (< /**budh-ta**/). This claim is additionally contradicted by native Sanskrit orthographic conventions (cf. Joseph & Janda 1988b).

As for K&L's claim that voiced aspirates must deaspirate in syllable codas, thereby triggering automatic delinking and relinking, it should be noted that the testimony of native Sanskrit phoneticians clearly reveals the syllabification of forms such as **budhna**- 'bottom' to have been [budh$na-], with voiced aspiration precisely in a syllable coda, and not *[bu$dhna-], where the first syllable would be open and the second would begin with a cluster of a voiced aspirate stop plus a nasal.

Overall, then, autosegmental attempts have so far failed to provide a convincing purely phonological account for ATB: even major changes in phonological theory do not alter the fundamental character of how the ATB alternations must be handled in a grammar of Sanskrit. Accordingly, we turn now to a non-phonological account cast in a likewise more current theoretical framework for morphology.

5. PROCESS MORPHOLOGY AND SANSKRIT ATB

Most former and many current approaches to word structure consider (non-compound) morphology to be essentially the expression of morphological categories (like plurality, tense, etc.) by adding to some root (and its syntax/semantics) further phonological (and syntactico-semantic) material associated with such categories--usually via affixation. This Item-and-Arrangement-like orientation is maintained today especially by two approaches: the "[Morphology as the]Syntax of Words" of Lieber, Strauss, Selkirk 1982, Williams, and others, and the "Autosegmental"/"Prosodic"/"Nonconcatenative" Morphology of Halle & Vergnaud 1980, McCarthy 1981, Marantz, Archangeli, Yip, and others (for fuller references and discussion, cf. Hoeksema & Janda 1988; the second of these two approaches is much more "Three-Dimensional" and hence obviously more like current phonology).

However, there has always existed, at least since Pāṇini, a view that (non-compound) morphology is the expression of morphological categories via application to some root (and its syntax/semantics) of morphological processes associated with such categories (including syntactico-semantic properties)--whereby the additive operation of affixation, though by far the most common process, is complemented by morphological marking via replacement (e.g., substitutions like Ablaut), subtractions (e.g., so-called truncations), and even permutations (like the widely-ignored morphological metatheses in several languages), as well as by combinations of these operations. For a processual overview and references, cf. now Hoeksema & Janda 1988. Besides ourselves and the first author just mentioned, the list of adherents of such "Process Morphology" (PM) includes not only Pāṇini but also Sapir and, more recently, Anderson, Aronoff, Bach, Beard, Dowty, Matthews, Schmerling, and Zwicky.

The most crucial and controversial aspect of PM concerns the fact that, since its morphological operations manipulate the phonological material of roots in not only additive but also replacive, subtractive, and permutational ways, the structual changes of such rules are often reminiscent of--and even occasionally identical to--those of purely phonological rules. Still, this allegedly suspect formal similarity between the separate domains of morphological processes and phonological rules is, first of all, mainly a function of the available logical possibilities and, second of all, unique in its usefulness: not only for explaining the ubiquitous historical phenomenon whereby phonological rules are morphologized, but also for avoiding the Scylla-and-Charybdis perils of so-called "morphophonemics"--as an orphan often mangled (depending on one's theory) either by a tug-of-war or by a baby-with-the-bathwater dumping between phonology and morphology "proper". In PM, that is, there simply is no morphophonemics, nor are there any "morphologically conditioned phonological rules"; sound-related generalizations belong to morphology (or the lexicon) if they refer to morphological (or lexical) information, but to phonology otherwise. Most trenchantly put, though: it is simply not the case that everything in language which involves sound (as do morphological processes) must ipso facto belong to the

specific subdomain of phonology, or else we must countenance the absurd conclusion that, given the undeniably phonological manifestations of the various orderings, groupings, dependencies, and presences vs. absences which constitute syntax, that field, too, must be treated as part of phonology.

Adopting this logic, then, we here offer a small contribution to a modern, neo-Pāṇinian PM of Sanskrit by providing an outline analysis of ATB phenomena which is avowedly morphological, despite its partial reference to certain phonological features. To repeat, the processes involved are by no means "morphologically-conditioned phonological rules"; instead, because they refer crucially to non-phonological, morphological categories, these processes are morphological rules. The phonological features which they manipulate and/or have as part of their conditioning are merely the necessary material with reference to which they express the relevant morphological categories.

Sanskrit ATB occurs in two situations: with suffixed forms and with unsuffixed forms. For the latter, which obviously end in a root morpheme, ATB must clearly occur by itself as a morphological process. By "ATB", we mean only 'the occurrence of aspiration as a morphologically derived feature of root-initial stops', since independently motivated phonological rules are responsible for root-final stops (both voiced and voiceless) losing their underlying aspiration before obstruents or a pause. We may thus consider final deaspiration to be essentially unconnected-- e.g., "unlinked"--with the aspiration derived in the initial voiced stops of roots. On this view, aspiration is not "thrown back" in the sense that the same aspiration element (= feature or feature combination, whether a submatrix or an autosegment) which originates in root-final position would be linked or moved to root-initial position. Rather, before the simple and independent disappearance, under certain phonological conditions and via a phonological rule, of root-final aspiration, there applies, under centrally morphological conditions, a morphological rule whereby a new but identical-looking aspiration feature (= submatrix or autosegment) pops up root-initially--as if it had been "cloned" there.[11] Adopting (for purposes of spatial economy) a flattened version of the format used for morphological processes in the "Extended Word-and-Paradigm" theory (cf., e.g., Anderson 1982), plus ad-hoc phonological and morphosyntactic features, we can formulate "suffix-free" ATB for, e.g., Sanskrit VOC.SG. root-noun forms like **-bhut** (cf. (7)f above) in the following way: [+NOUN, +VOC., + SG.] /([C, <-continuant, +voiced>]) $[+segment]_0$ ([C, <+voiced, +aspirated>])/ ==> /[1, <+aspirated>] 2 3/. This process, though in many respects identical to the ATB rule of Sag 1976 (= (14) above), nevertheless differs crucially from the latter in referring to particular morphosyntactic features rather than a word boundary.[9]

For the ATB that cooccurs with suffixes, on the other hand, we can simply follow the common PM practice of combining two or more operations within the same process--here, suffixation and ATB. Thus, e.g., the morphological rule required for forms such as 2.PL.PRES.IND.MID. **dhug**-dhve (cf. (7)j above) is: [+VERB, +2., +PL., +PRES., +IND., +MID.] /([C, <-continuant, +voiced>]) $[+segment]_0$ ([C, <+voiced, +aspirated>])/ ==> /[1, <+aspirated>] 2 3 + dhve/. In order to express the fact that the ATB which occurs in both of the above rules is the same process, we employ a "redundancy metarule" ("meta-redundancy-rule") in the sense of Joseph & Janda 1986: a static generalization which parses as identical all occurrences, in individual morphological rules, of a particular formal operation, thereby linking such processes as parts of a single "rule constellation" (cf. also Janda & Joseph 1986). These same devices (redundancy metarules and rule constellations) are likewise available for expressing the further unities (besides ATB) which exist across most of the several other morphological processes of Sanskrit that combine suffixation with ATB: e.g. the suffix-initial -/s/... shared by the verbal 2.SG. rules for ACT. primary -/si/ and secondary -/s/ and MID. primary -/se/ and IMPLR. -/sva/ (perhaps also to be related to the further verbal rules for FUT. -/sya/-, DESID. -/sa/-, and AOR. -/s/-, -/sa/-, or -/-sis/-, as well as the root-nominal rules for M./F. NOM.SG. -/s/ and LOC.PL. -/su/). Similar redundancy metarules and rule constellations allow groupings across the various ATB-containing processes for -/bh/...-suffixation, -/dh/...-suffixation, and the remaining, suffixless ATB forms. Finally, we combine lexical listing for idiosyncratic forms with lexical-correspondence (redundancy) rules (cf. Janda 1987 and his references) in order to handle exceptional morpheme combinations like with those allomorphs of √dha:- which fail to trigger BL but do show ATB: e.g., /dhad+te/ $_{[3.SG.PRES.IND.MID.]}$ (> [dhatte]), whereby /dha:/ ~ /dhad/(~ /dadh/).

Since the present context does not allow us to list the full set of Sanskrit rules involving ATB, the representative examples given so far will have to suffice for this occasion. Still, we believe that they permit one to visualize the proportions of our overall approach. Most centrally, we posit what may seem like a large number of morphological rules involving ATB--at least 20 (cf. the list of morphological environments in (9) above)--which is so thorough a fragmentation as to suggest the possibly massive loss of generalizations. And, indeed, the phonetically natural devoicing/deaspirating environment "/__ -/s/...", for instance, is admittedly dispersed, in our analysis, across numerous ATB-cum-suffixation processes. Yet the undeniable existence of phonologically more unnatural ATB environments like "/__ -/dhve/" and "/__ -/dhvam/" (but not "/__ -/dhi/", or "/__ -[dhva:]" < -/tva:/) strongly suggests that those shared natural-seeming contexts which are scattered across many rules really are just relics that are now no longer directly relevant to the operation of ATB.

Such a situation makes good historical sense and is actually not uncommon. For example, we claim that, when the phonological rule of GL operative in pre-Sanskrit Indic was lexicalized, reduplicationalized, and inversely morphologized, ATB sprang into immediate multiple existence as a fragmented set of identical operations by being simultaneously incorporated into more than a dozen suffixation processes. This may seem controversial, but it is exactly parallel to the way in which the formerly phonological rule of umlaut, when it was morphologized in earliest Old [O] High German [HG] (cf. Janda 1983), came in one fell swoop to be part of a vast number of suffixation-rules which today total approximately sixty--whereby umlaut can be shown to involve distinct rules because it has more than one structural description (cf. Janda 1982). Since rules like pre-OHG phonological umlaut are often conditioned by sound-structural configurations which appear in numerous affixes, it is not at all surprising that the morphologization of a single such purely phonological rule can create--overnight, as it were--numerous morphological rules each combining a different affixation with the same formal sound-manipulating process. Thus, today, few generativists would any longer deny that umlaut is a morphological rule, even though several of the suffixes before which it applies contain front (high) vowels and though autosegmental phonology is now at hand. Nearly all current phonologists, then, would reject an analysis where, for a Modern [N] HG word like Gäste 'guests' (cf. Gast 'guest'), the umlaut would arise when an underlying second-syllable [-back]-autosegment spreads to a vowel on its left (as perhaps from /i/ in pre-OHG) after being unlinked from its original vowel, so that /gast+i/ --> [gäst+ə] (with the realization in NHG of the suffix vowel as schwa being achieved via the operation of a default rule). Instead, it is now standard to analyze, e.g., Gäste as having its first vowel umlauted directly by one instantiation of a widespread morphological rule which can be linked with the addition of the suffix -e, among many others (cf. Janda 1982, 1983, 1987, and references there).

Of course, there are certain obvious differences between the morphologized processes of umlaut in NHG and ATB in Sanskrit: the former is not generally the result of rule inversion, e.g., nor do alternations always justify positing umlaut features in underlying forms as well as derived ones. Nevertheless, the juxtaposition of the two processes is both apposite and instructive. NHG umlaut establishes the plausibility of a sound-structural phenomenon where extremely numerous morphological rules contain the same operation of anticipatory feature marking which is usually associated with final-reduction processes but quite often possesses no apparent phonological triggers within its suffixal environments. Given this well-known and well-accepted precedent, we do not hesitate to propose for Sanskrit an analysis of ATB where that operation is an aspect of many morphological processes which include suffixation but also often receive no clear phonological conditioning from their suffixes. It is simply the endlessly taught lesson of language change that dephonologization via morphologization and lexicalization invariably leads to potentially extreme rule mitosis of this sort involving temptingly widespread phonological similiarities (cf. Janda & Joseph 1986, Joseph & Janda 1988a). In fact, this happens to such an extent that the aftermath of morpholexicalization might be said to present a post-war-like scene of hacked-apart naturalness, as in the case of ATB and the other Sanskrit aspiration alternations that we have discussed here. Yet, if we may conclude along these lines by drawing a further parallel between the Germanic sphere and Indic, the lesson of history also seems to be that the apparent carnage left by the battle between phonology and morphology--in language as well as in linguistics--is favorably viewed by speakers as yielding (at least in the former case), not inert

corpses, but, rather, prime candidates for a continuing life in Valhalla.

FOOTNOTES

* The authors' names occur alphabetically and thus do not reflect any disparity in our respective contributions, which have been essentially equal in every way. For valuable comments and discussion, we would like to thank Mark Aronoff, Tony Kroch, and especially George Cardona and Don Ringe.

1 We ignore here a few exceptions to this generalization which occur in onomatopoeia.

2 Regarding the examples here and elsewhere: [g] is the regular result of deaspirating /h/ (as if from /gh/); this [g] may then become [k] prepausally or before a voiceless obstruent (across either a + or a # boundary). The vocalic alternations exemplified below and later in this paper are not relevant for the present discussion of Sanskrit aspiration, and so we say nothing about them in this work.

3 Some surface occurrences of deaspirated word-final stops need not be analyzed as having lost their aspiration by word-final deaspiration; instead, they may actually instantiate the same generalizations as those illustrated above (in the main text) by (1), (2), or (3): viz., deaspiration before -/s/..., -/t/..., or some other dental stop, respectively. This is especially plausible because the traditional analysis of, e.g., the non-neuter NOM.SG. posits an underlying final -/s/(-morpheme) whose deletion can be achieved following an obstruent by an independently motivated rule of Sanskrit phonology which deletes all but the first member of a word-final consonant cluster: as, for instance, in /bhara-nt-s/ --> bharan 'bear'-ACT.PRTCPL.-MASC.NOM.SG. In this way, the finally-deaspirated surfacing of, e.g., samidh- 'wood' as F.NOM.SG. samit (homophonous with the F.VOC.SG. in (4) above) could derive directly from either /samidh-s/ or /samidh#/--the latter itself perhaps being derived, via the abovementioned phonological cluster-reduction rule, from underlying /samidh-s/. That is, given cluster reduction (CR) and both deaspiration before obstruents (DBO) and deaspiration before word boundary (DB#), there are three possible derivations for NOM.SG. samit: from /samidh-s/ via DBO and then CR; from /samidh-s/ via CR and then DB#, and from /samidh/ via DB#. Similar analytical possibilities (i.e., ambiguities) exist for verb forms where a single segment -/s/ or -/t/ occurs as a word-final person/number ending. However, there do exist clearer cases of word-final deaspiration: for instance, the other example in (4), kapṛt 'penis', instantiates a root (kapṛth-) which is neuter and therefore probably undergoes deaspiration not in the form */kapṛth-s/ but rather only as /kapṛth#/ (although some analysts posit /-s/ even here--cf. Katre 1987:673 [(Rule) 6.1.68]).

4 This loss of aspiration in reduplication is the only productive synchronic (rule-)remnant of the sound-change known as "Grassmann's Law" (GL). That iterative process originally operated (cf. Schindler 1976:625ff. [(10)]) so as to deaspirate an obstruent followed within a word by an aspirate from which it was separated by at most one vowel--potentially flanked by certain permissible consonants--either across morpheme boundaries (as in reduplication) or entirely within a morpheme (i.e., in diaspirate roots). Outside of reduplication, however, the effects of GL were gradually altered and reanalyzed. Thus, since Sag 1976, Schindler 1976, and Vennemann 1979, most generative phonologists have followed the lead of Pāṇini (cf. Katre 1987) and Whitney 1889 in (i) recognizing no underlying diaspirate roots for Sanskrit (thereby lexicalizing, as it were, the morpheme-internal root-initial deaspiration effects of GL) and (ii) analyzing cases where initial aspirates seem to survive in some allomorphs of once-diaspirate roots (due to other deaspiration processes--applying before certain suffixes and word-finally) by means of rules adding ("throwing back") aspiration to root-initial voiced stops under particular conditions. It is with the second of these two issues that the present study is mainly concerned (cf. especially (7) et seqq. in the main text). Since the abovementioned Pāṇinian approach is a rule-inversion analysis (cf. Vennemann 1972) which implies not only that GL was effectively eliminated from Sanskrit grammar (both through incorporation into reduplication and through lexicalization) but also that certain formerly underlying root-initial voiced aspirates were reanalyzed as derived (via throwback), the latter process has sometimes been called "Reverse(d/ of) Grassmann's Law" (cf., e.g., Vennemann 1979:560 and Schindler 1976:627).

5 In the more up-to-date terms of current non-linear phonology and morphology, reference to boundaries actually represents a specification that an element occurs at the margin of a certain higher-

level constituent to which it hierarchically belongs. An "internal word boundary" thus indicates that two adjacent morphemes are in fact part of separate word domains (and so linked with distinct word nodes) within a larger word domain. Also, in Lexical Phonology (cf. the overview in Kaisse & Shaw 1985), internal-word-boundary effects can be achieved via the judicious assignment of various phonological and morphological rules to different lexical levels. However, this option is not crucially relevant to the central issues of this paper, so we must postpone discussion till some future occasion.

6 The environments in (8) that do not involve a word boundary (#) all arise only across a morpheme boundary (+), never within a root or an affix, and so could be expressed more revealingly vis-à-vis morphology (albeit less phonologically and slightly less economically) as follows (cf. the similar practice of Schindler 1976:635): a'. **budh-** = /___ + [+sonorant]; b.i' **bhut-** = /___ + [+strident, -voice]; c.i' **bhud-** = /___ + [+voice, +aspirated, +coronal] [-syllabic, -consonantal, +labial]; d'. **bud-** = /___ + [+voice, +aspirated, +coronal] V.

7 On the basis of their complementary distribution in texts, Cardona (to appear) demonstrates that the variants in question "belonged to different dialects" and are distributed in the Rigveda "according to different ṛṣis", with the ATB variants being the "modernizing type" (consistent at least by the time of Pāṇini's predecessor Śākalya).

8 While it is "fairly certain" even for early Vedic that "native speakers did not perceive any semantic link between grtsa- and grdh" (so Cardona [to appear]), it is nevertheless likely that a perceived morphological relationship between these forms must have existed at some earlier stage(s). Perhaps also relevant are similarly ATB-less **gut-sa-** 'bundle' and √**gudh-** 'envelop', which were folk-etymologically connected by some native grammarians --a point we plan to take up in a future paper.

9 This rule is similar (although not, as implied by Sag, identical) to the earlier version in Sag 1974: 604 [(23)], which follows Pāṇini's rule 8.2.37 (cf. Katre 1987:998) and is itself almost exactly followed (except for the addition of a "+" boundary before each of /s/ and /dhv/) by the rule "R[everse of]Grassmann's]L[aw, version]3"--for late Vedic and for Classical Sanskrit--given in Schindler 1976:631 [(23)], 635. However, these ATB rules of Pāṇini, Sag 1974, and Schindler are actually formulated entirely in terms of segments and boundaries and so could be considered phonological, rather than morphological, except in that they mention root(-features or -boundarie)s. And even Sag 1976:616-17 views ATB as a "morphological rule... that mention[s] both phonological and morphological environments" (presumably. {/s/, #} and {-/dhve/, -/dhvam/}, respectively) and so not as a completely morphological rule--in contrast to what we here argue in Section 5 below.

10 We do not discuss in this section Stemberger's previously mentioned 1980 account of the Sanskrit aspiration alternations, despite its autosegmentality, because he rejects an ATB approach in favor of a pseudo-historical treatment with GL. Nonetheless, Stemberger's analysis suffers from some of the defects which are discussed in this section as undercutting B&M's and K&L's treatments (such as the former's mistaken claim that no root-final deaspiration occurs in BL forms and the latter's erroneous syllabification for certain consonant clusters), as well as other flaws (e.g., ignoring the numerous exceptionally diaspirate roots which show GL not to be surface-true for Classical Sanskrit). These and related issues are taken up at much greater length in Janda & Joseph 1987.

11 Based on a discussion with M. Aronoff, we have also considered an alternative approach whereby final deaspiration occurs at the same time, and via the same rule, as initial ATB. The less appealing way to do this is simply to make, in certain (ATB) morphological environments, a simultaneous specification of a root-final voiced aspirate as [-aspirated] and a root-initial voiced stop as [+aspirated]. The more appealing option is a non-linear one involving morphologically conditioned unlinking ("launching") of an aspiration autosegment from a root-final voiced aspirate in ATB environments, since the association of such an autosegment with a root-initial voiced stop can then be made to follow automatically from general principles--so that both ATB and deaspiration are effectively achieved via the same operation. This analysis, while autosegmental, is nonetheless morphological and not phonological: it manipulates sound in particular morphological categories as a way to mark those categories.

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